(No Model.)

T. A. EDISON.

TELEGRAPHY.

No. 422,073. Patented Feb. 25, 1890.

Fig. 1.

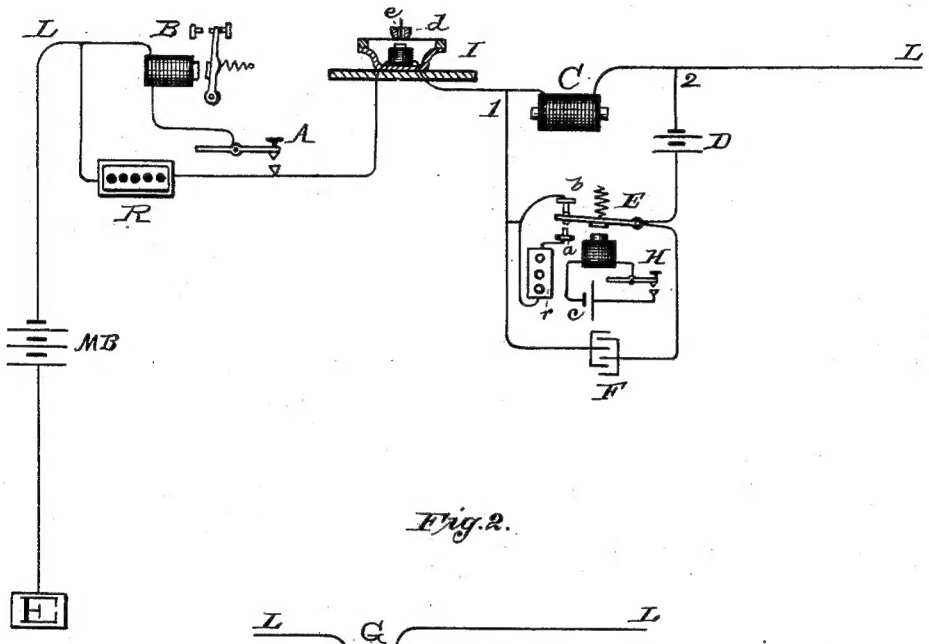


Fig. 2.

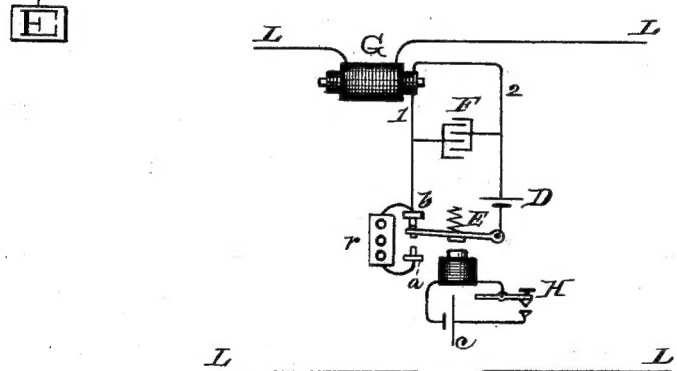
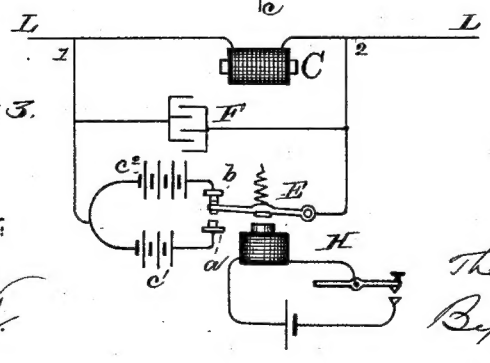


Fig. 3.



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TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 422,073, dated February 25, 1890.

Application filed November 24, 1885. Renewed October 11, 1889. Serial No. 326,652. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented a new and useful Improvement in Telegraphy, (Case No. 655,) of which the following is a specification.

My invention is an improvement upon the induction apparatus employing transmitters and receivers of induction impulses, and hereinafter referred to as "induction" apparatus, such apparatus being fully described in patents issued to me numbered 333,289 and 333,290, whereby the capacity of a telegraph-line can be increased by transmitting and receiving Morse signals produced by momentary and sharply-defined induction impulses, which do not interfere with and are not affected by the ordinary Morse signals.

My object is to simplify the induction apparatus and make it more efficient. For each induction-transmitter I use a source of electrical energy separate from the usual line-battery operating the ordinary Morse instruments when they are employed and a transmitting-circuit controller opening and closing the circuit of this separate battery and throwing induced impulses upon the line. The points of the transmitting-circuit controller are shunted by a condenser, which absorbs the spark at the points, and also sharpens the impulses, so as to materially improve the operation of the induction apparatus. The induction-transmitter circuit may be a primary coil, with secondary in line; but I prefer to make this induction transmitter circuit simply a shunt around an electro-magnet in the line. This shunt includes a local battery and the transmitting-circuit controller, with points shunted by condenser, and by opening this shunt the magnet will discharge upon the line, producing a momentary and sharply-defined impulse, while the closing of the shunt will form a complete local circuit, including the battery and magnet, and the magnet will be energized, ready to be discharged at the next opening of the shunt.

For the transmitting-circuit controller I prefer to employ a sounder-closing circuit at both front and back points. This sounder is worked by a key and local battery. Normally the sounder closes the induction-transmitter circuit at its back point; but when the key is depressed the sounder-armature moves to its front point, first opening and then closing the induction-transmitter circuit. The raising of key produces the reverse movement of sounder-armature, which returns to its normal position, opening and closing circuit in doing so. The induction on closing is so weak that the opening of transmitter-circuit alone makes a distinct signal in the induction-receiver.

To vary the alternate signals so as to prevent confusion in receiving, a resistance is introduced into the induction-transmitter circuit at one point only of the sounder. When the sounder opens circuit at this point, the impulse is weaker than when it opens at the other point, and this difference will be distinguishable at the induction-receiver. The resistance serves to weaken the battery-current for alternate signals corresponding to the upstroke of key. The same end can be accomplished by dividing the local battery between the sounder-points, a lesser amount of battery being in circuit with one point than the other.

For my induction-receiver I use a diaphragm or phonetic sounder, which may be a telephone-receiver of any ordinary form, such as an electro-motograph or magneto-electric telephone. This I place with its diaphragm in a horizontal position, and upon the center of the diaphragm I mount a loose weight, sleeved on a pin or otherwise held, which weight, by hopping on the diaphragm, increases the sound emitted. I prefer to use a magneto-electric telephone-receiver with a loose weight on its diaphragm, the instrument being connected directly in line.

The line is provided with two or more sets of the induction apparatus, and it may also be, and preferably is, provided with two or more sets of ordinary Morse instruments consisting of signaling keys and relays. A line-battery is used to work the regular Morse instruments, and the Morse keys are shunted to keep the line constantly closed for the induction signals. I prefer to do this by means of a high resistance, which may be ten thousand ohms or more. The shunt including this re-

sistance is around both the signaling-key and the relay, so as to prevent the relays from absorbing the induction impulses. This resistance, when thrown into circuit by the opening of the Morse key, is practically equivalent to a complete opening of the circuit, so far as the quantity currents used for the regular Morse signals are concerned, but it affords a closed circuit to the high-tension momentary and sharply-defined induction waves of the induction-transmitters.

There is no interference between the regular Morse and the induction Morse signals, and the two sets of signals are transmitted and received wholly independent of each other. I have found that this is due to the form of the waves, the regular Morse signals being produced by gradually rising and falling waves of comparatively low tension, while the induction signals are produced by short sharp waves of high tension. The Morse relays are too sluggish to respond to the sharp induction waves, while on the other hand the gradual and prolonged waves of the ordinary Morse move the diaphragm of the induction-receiver so slowly that the loose weight does not hop on the diaphragm, but moves with it.

In the accompanying drawings, forming a part hereof, Figure 1 is a view, principally in diagram, of apparatus embodying the invention; Fig. 2, a similar view showing a modified form of induction-transmitter, and Fig. 3 a view showing a modification of means for alternately varying the induction signals.

The line L L, grounded at its ends, has the usual main battery M B and two or more regular Morse sets, each composed of a signaling-key A and relay B, both of which are shunted by a resistance R—say of ten thousand (10,000) ohms. The line also has two or more induction sets. Each induction-transmitter is preferably an electro-magnet C in the line, shunted by a local circuit 1 2, including a battery D and transmitting-circuit controller E, the points of which are shunted by a condenser F. The circuit 1 2 may, however, be the primary of an induction-coil G, Fig. 2, with secondary in line.

The transmitting-circuit controller is preferably a sounder whose armature-lever closes circuit at both front and back points *a b*. The sounder is operated by a key H and local battery *c*.

To vary alternate signals, a resistance *r* is placed in the circuit of the front point *a*. This resistance may be adjustable, as may also be resistance R.

Another way of varying alternate signals is to divide battery D into two parts c' and c^2, connected separately with points *a* and *b*, the amount of battery in circuit with point *a* being less than that in circuit with point *b*.

The preferred induction-receiver is a magneto-electric diaphragm sounder I with coils directly in line. Upon the center of its diaphragm, which is horizontally arranged, is a weight *d*, held loosely by a pin *e*.

What I claim is—

1. In induction telegraphs, the combination, with the line and an induction-receiver, of an induction-transmitter comprising a battery, a circuit-controller, a condenser shunting the circuit-controller, and an inductorium translating the battery-impulses into momentary and sharply-defined waves upon the line, substantially as set forth.

2. In induction-telegraphs, the combination, with the line and an induction-receiver, of an induction-transmitter comprising a battery, a circuit-controller closing circuit at both front and back points, a condenser shunting the circuit-controller, and an inductorium translating the battery-impulses into momentary and sharply-defined waves upon the line, substantially as set forth.

3. In induction telegraphs, the combination, with the line and an induction-receiver, of an induction-transmitter comprising a battery, a key-controlled sounder closing circuit at both front and back points, a condenser shunting the circuit-controller, an inductorium translating the battery-impulses into momentary and sharply-defined waves upon the line, substantially as set forth.

4. In induction telegraphs, the combination, with the line and an induction-receiver, of an induction-transmitter comprising a battery, a circuit-controller closing circuit at both back and front points, means for weakening the battery-current at one point, and an inductorium for translating the battery-impulses into momentary and sharply-defined waves upon the line, substantially as set forth.

5. In induction telegraphs, the combination, with the line and an induction-receiver, of an induction-transmitter comprising a battery, a circuit-controller closing circuit at both back and front points, a signal weakening resistance in circuit with only one of such points, and an inductorium translating the battery-impulses into momentary and sharply-defined waves upon the line, substantially as set forth.

6. In induction telegraphs, the combination, with the line and an induction-receiver, of an induction-transmitter comprising a magnet in line, and a shunt around this magnet including a local battery and a circuit-controller, substantially as set forth.

7. In induction telegraphs, the combination, with the magnet in line, of the shunt around such magnet, including local battery, and the circuit-controller in shunt closing circuit at both front and back points, substantially as and for the purpose set forth.

8. In induction telegraphs, the combination, with the magnet in line, of the shunt around such magnet, including local battery, the circuit-controller in shunt closing circuit at both front and back points, and a resistance in circuit with one of such points, substantially as and for the purpose set forth.

9. In induction telegraphs, the combina-

tion, with the magnet in line, of the shunt around such magnet, including local battery, a circuit-controller in shunt, and a condenser shunting points of circuit-controller, substantially as and for the purpose set forth.

10. In induction telegraphs, the combination, with the line and an induction-transmitter of Morse signals, of an induction-receiver consisting of a diaphragm sounder having a loose weight or hopper carried by the diaphragm, substantially as set forth.

11. In induction telegraphs, the combination, with the line and an induction-transmitter of Morse signals, of an induction-receiver consisting of a magneto-electric diaphragm sounder with coils directly in the line, and having a loose weight or hopper carried by its diaphragm, substantially as set forth.

12. The combination, with a line and two or more sets of regular Morse instruments, composed each of a signaling-key and relay, a continuous shunt-circuit around each key and relay, including a high electrical resistance, and a line-battery for operating these instruments, of two or more sets of induction (Morse) instruments, each set composed of a transmitter provided with a separate battery and throwing momentary and sharply-defined waves upon the line, and a diaphragm sounder responding to such momentary and sharply-defined waves, substantially as set forth.

This specification signed and witnessed this 12th day of November, 1885.

THOMAS A. EDISON.

Witnesses:
A. W. KIDDLE,
E. C. ROWLAND.